



NASA STTR 2005 Phase I Solicitation

T3.01 Aerospace Communications

Lead Center: GRC

The research sought under Aerospace Communications focuses on the development of innovative communications, architectures, networks, and subsystems that significantly increase the capacity and connectivity among satellites, spacecraft, aircraft and ground networks thereby enabling new applications and services. These technologies are aimed at improving the power, bandwidth, and cost efficiency of communications at millimeter-wave frequencies and higher, and the interoperability, reliability, security, and quality of services of aerospace networks. The goal is to address the requirements of: NASA's Vision for Space Exploration, National Airspace System capacity, safety, and transportation initiatives; NASA's mission-unique applications; and NASA's utilization of emerging commercial communications services.

Innovations solicited include:

- Development of monolithic microwave integrated circuit (MMIC)-based arrays and array feeds, large-aperture inflatable antennas, miniaturized antennas, and trade-off studies among different antenna technologies for space applications. Potential lower cost, space-fed, active array and reflectarray approaches are also of interest as well as other MMIC and non-MMIC-based approaches (e.g., MEMS-, ferroelectric-, and optical-based approaches);
- Radio Frequency (RF) and optical propagation phenomena through atmosphere and turbulent media, development and validation of communication systems for aviation safety and aviation capacity, and other related electromagnetic phenomena;
- Digital communications, navigation, and surveillance technologies required for aeronautical communications, navigation, and surveillance (CNS) and space communications systems. Specific technologies include: software-defined radios; low-power, reconfigurable transceivers; multi-function, multi-mode digital avionics; network interface controllers, hubs, and routers for space; bandwidth- and power-efficient digital modems; advanced signal processing techniques; and integrated microelectronic or optoelectronic devices;
- Research and development of advanced microwave materials, devices, and circuits as well as the technologies required for integrating individual circuit components into microwave subsystems. Research in high-power transmitters focused on improving efficiency, RF power output, reliability, operating life, and communications qualities (such as linearity of a traveling wave tube amplifier for use in space communications). RF power combining techniques at Ka-Band frequencies are also of interest;

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- Research on semiconductor circuits for transmit and receive modules in operational frequency bands designated for NASA's Exploration Systems vision. Specific technologies under development include: wide bandgap semiconductors, such as gallium nitride and silicon carbide; III-V semiconductors; silicon germanium; radio frequency micro-electromechanical systems (RF MEMS) devices/circuits; radio frequency integrated circuits including transmission lines and passive components; and microwave circuit packaging techniques;
 - Cryocooled ultra-sensitive receivers for use in terrestrial antenna arrays for reception of signals from deep space and for inter-satellite links;
 - Emerging technologies such as, multi-Gb/s photonic and nano-electronics based devices and circuits; and
 - Research and development of advanced aerospace communications network architectures, protocols, standards, technologies, and network-based applications. Specific areas of interest include transmission control protocols, modifications, and enhancements to mitigate variable delays and high latency, next generation transport protocols, mobile-Internet protocols/routing, ad-hoc networking, and quality-of-service protocols, design, and implementation of advanced hybrid architectures to support NASA applications.